



Can *Arabidopsis thaliana* Seeds Survive Exposure to Extreme Cold?

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Background

Arabidopsis thaliana is a small flowering plant, from the Mustard (Brassicaceae) family. The mustard (Brassicaceae) family includes cultivated species such as cabbage and radish. *Arabidopsis thaliana* have a rapid life cycle (6 weeks from germination to mature seeds) and is native to Europe and Asia.

A. thaliana has a winter annual life cycle. Seedlings germinates in fall or late summer, over winter as rosettes, and flower in early spring or summer).

Depending on the type of plant, the affects of cold temperature varies. Some plants, like *A. thaliana*, need a period moist cold temperature before germination.

A. thaliana was chooses specifically because it is tolerant, even dependent, on cold environmental temperatures.

Liquid nitrogen is very cold. At normal atmospheric pressure it's between -196 to -210, substantially below the normal winter temperatures experienced by *A. thaliana* seeds.



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Hypothesis

The *Arabidopsis thaliana* Columbia (Col-0) and will not germinate after exposure to liquid nitrogen from one minute and up resulting in no growth. The *Arabidopsis thaliana* that are least exposed to liquid nitrogen and 24 hours (-4°C) in the freezer, will grow.

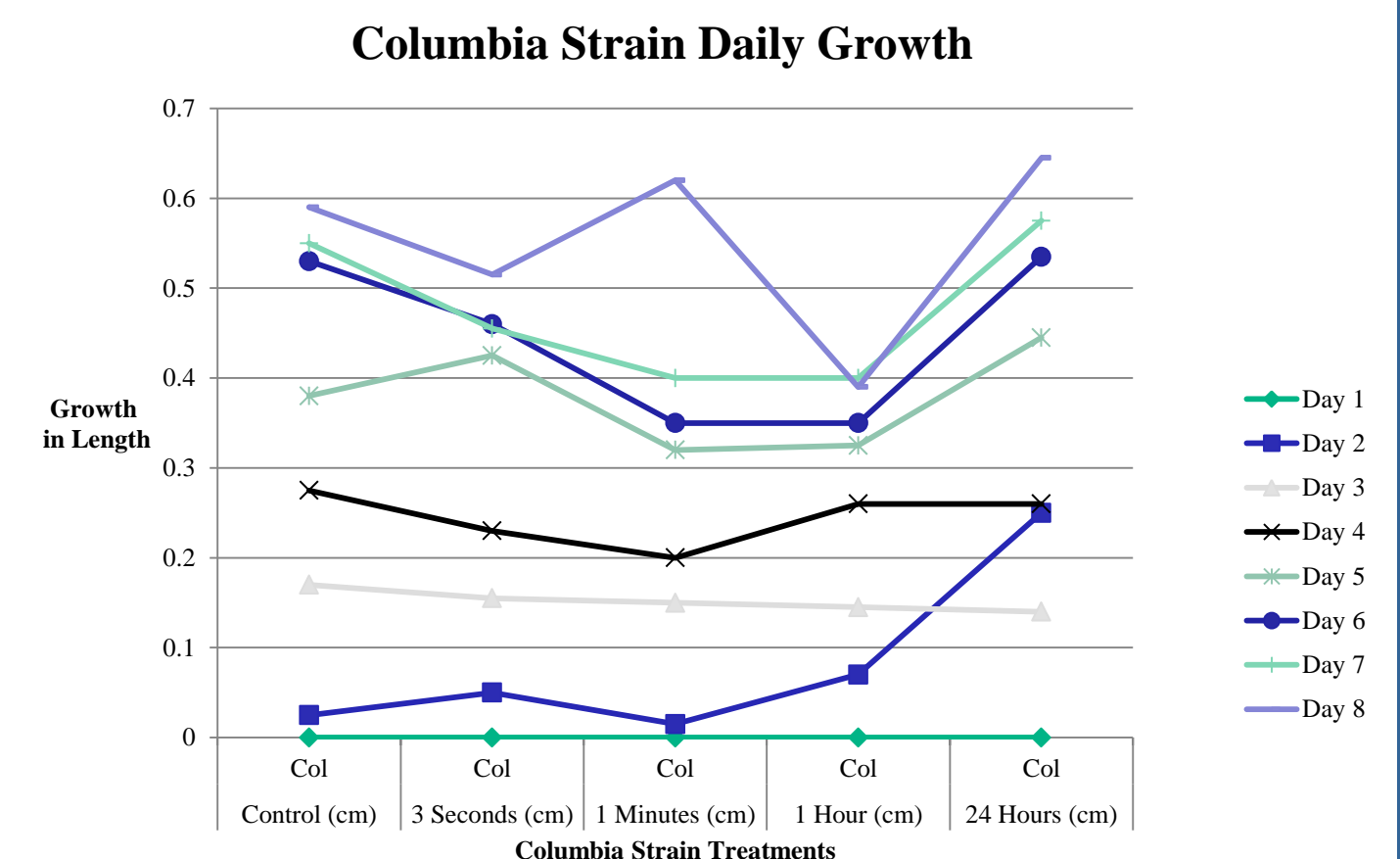
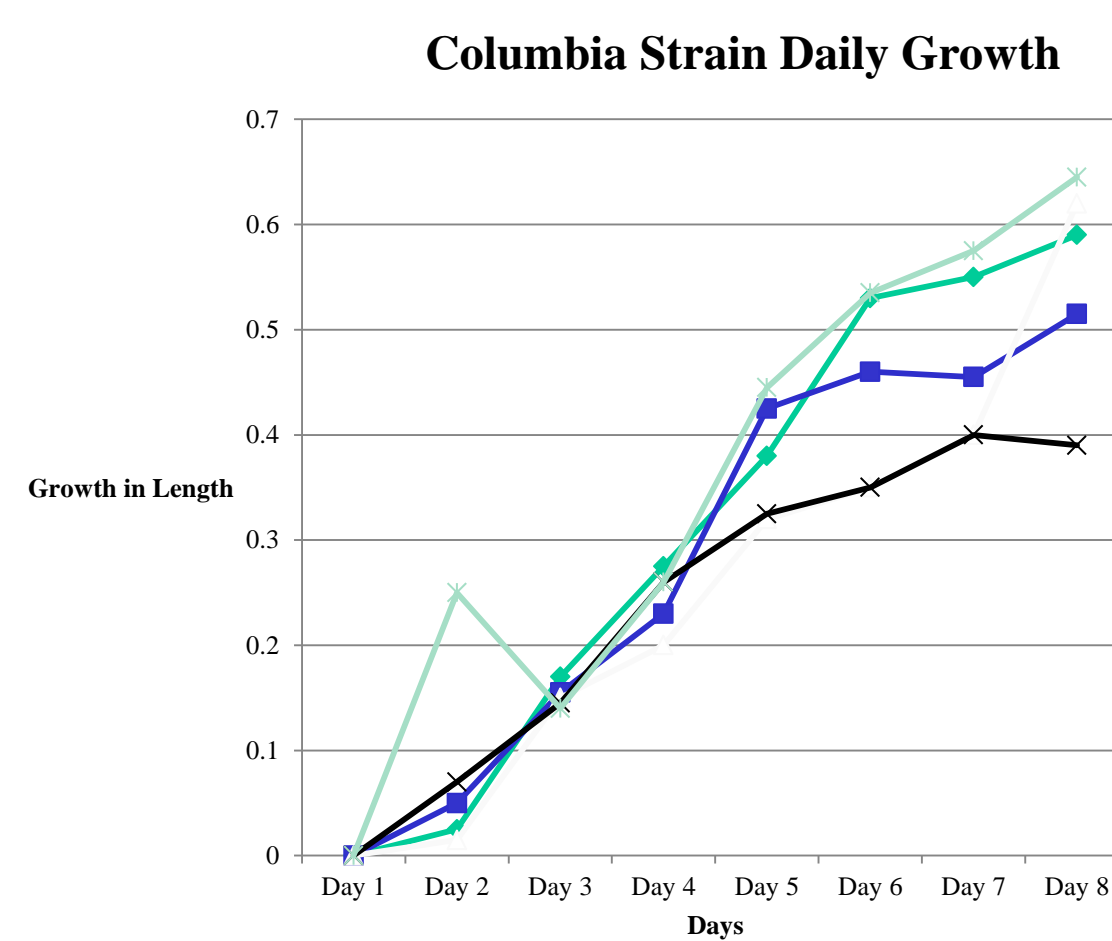


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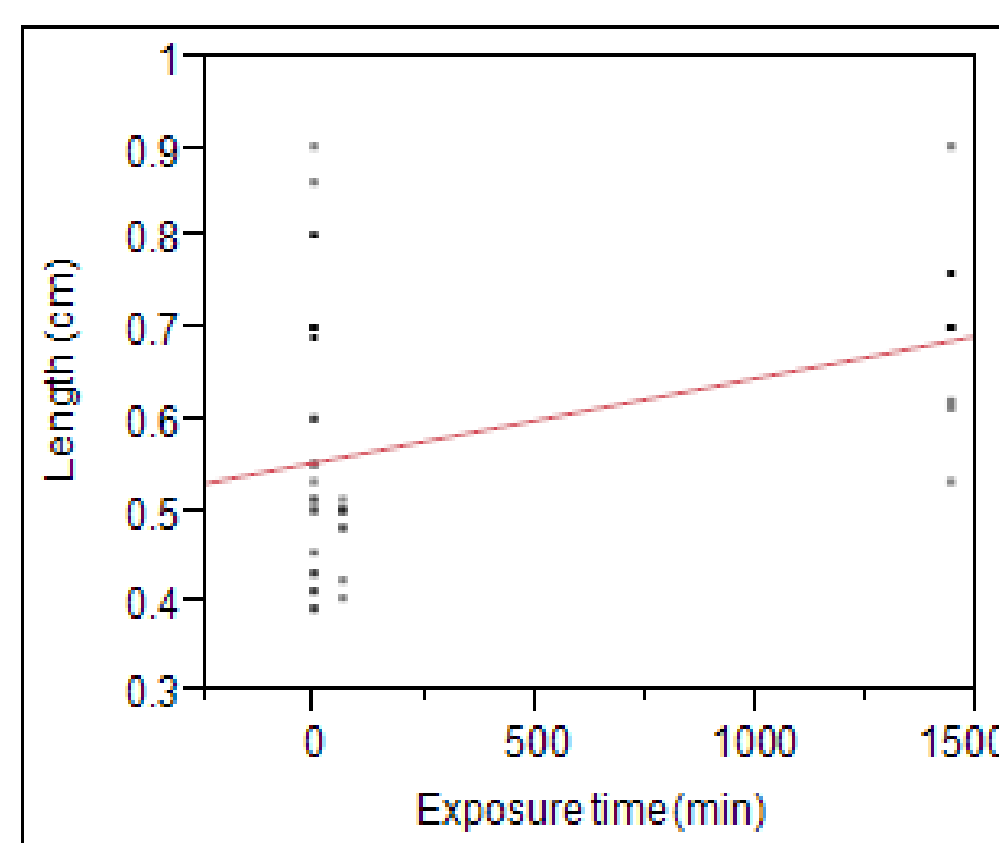
Method

Arabidopsis thaliana seeds (Columbia strain) were exposed to 5 different treatments. The Columbia strain was used because of its resistance to cold temperature, making it the perfect strain for this experiment. The treatment includes the control with no exposure, 24 hours in the freezer (-4°C), 3 sec to liquid nitrogen, 1 min to liquid nitrogen and 1 hour to liquid nitrogen, after stratification. The growth treatment was in agar plates called UltraSpec-Agarose™ Gel. Each plate was separated in half. In both halves, there were approximately 8-10 seeds each from both strains in the same medium, with the plates labeling Control, 24 hours, 3 sec, 1 min, and 1 hour. The plants grew in a 20°C temperature and 18°C at night. Plants was exposed to 16 hours of light and 8 hours of dark. After germination the overall length of each plant was recorded daily for 8 days. The longest and the shortest plant measured was recorded, the average of the two data recorded was considered the overall growth of the Col-0 strain within its specific treatment.

Results



Length of the Seedling Vs. Exposure Time



Rsquare : 0.13429
Prob > F : 0.0200*

Shows the Columbia Strain's growth between days 5-8 as exposed to liquid nitrogen. There is statistic significant increase in seedling length with increasing exposure time.

Conclusion

The best growth was in the 24 hour treatment. Slight exposure to liquid nitrogen may cause acceleration in growth in the Columbia strain. The acceleration in growth could be due to the cells ability to want to grow more rapid once exposed to extremely frigid temperatures. The Columbia strain can tolerate the extreme cold temperatures of liquid nitrogen and general cold temperature.



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